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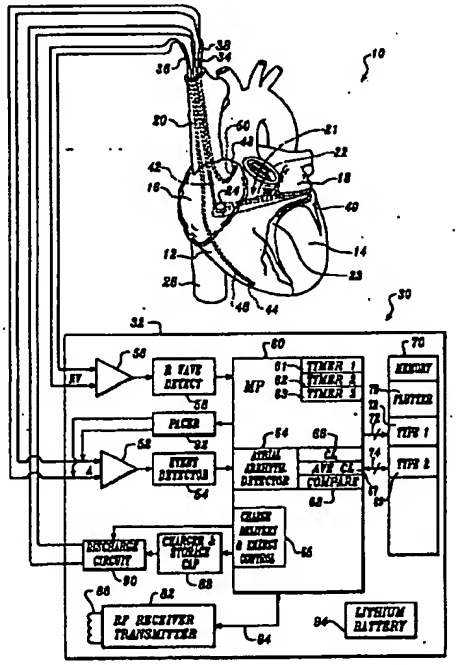
(71) Applicant: **INCONTROL, Inc.**
Redmond, Washington 98052-6734 (US)

(72) Inventors:
- **Ayers, Gregory M.**
  Duvall, WA 98052 (US)
- **Alferness, Clifton, A.**
  Redmond, WA 98053 (US)

(74) Representative: **UEXKÜLL & STOLBERG**
Patentanwälte
Beselerstrasse 4
D-22607 Hamburg (DE)

(54) Atrial fibrillation type selective cardiovertor

(57) An atrial cardiovertor/defibrillator (30) provides therapy to the atria corresponding to the type of atrial arrhythmia occurring in the atria of the heart. The atrial cardiovertor/defibrillator includes a memory (70) for storing respective different criteria for each of different types of atrial arrhythmia, a sensor (52) for sensing activity of at least one of the atria of the heart to provide an electrogram signal, and a cardiovertor (90) for providing a corresponding therapy to the heart for each of the different types of atrial arrhythmia. The cardiovertor/defibrillator further includes an atrial arrhythmia detector (64) responsive to the electrogram signal and the stored criteria for identifying one of the types of atrial arrhythmia to cause the cardiovertor to provide therapy to the heart corresponding to the identified atrial arrhythmia.



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Description

BACKGROUND OF THE INVENTION

The present invention generally relates to an atrial cardiovertor/defibrillator for applying cardioverting electrical energy to the atria of a human heart in need of cardioversion. The present invention is more particularly directed to an improved atrial cardiovertor/defibrillator which provides cardioversion therapy corresponding to the relative degree of organization/disorganization of a detected atrial arrhythmia.

Atrial fibrillation is probably the most common cardiac arrhythmia. Although it is not usually a life-threatening arrhythmia, it is associated with strokes thought to be caused by blood clots forming in areas of stagnant blood flow as a result of prolonged atrial fibrillation. In addition, patients afflicted with atrial fibrillation generally experience palpitations of the heart and may even experience dizziness as a result of reduced cardiac output.

Atrial fibrillation occurs suddenly, and many times can only be corrected by an external defibrillator discharging electrical energy to the heart through the skin of the patient. This treatment is commonly referred to as synchronized cardioversion and, as its name implies, involves applying electrical defibrillating energy to the heart in synchronism with a detected R wave of the heart. The treatment is very painful and, unfortunately, most often provides patients only with temporary relief lasting but a few weeks to months.

Drugs are available for reducing the incidence of atrial fibrillation. However, these drugs have many side effects and many patients are resistant to them, which greatly reduces their therapeutic effect.

Implantable atrial defibrillators have been proposed to provide patients suffering from occurrences of atrial fibrillation with relief.

Such known atrial defibrillators either do not provide atrial fibrillation detection or detect for the simple presence or absence of atrial fibrillation. All such atrial defibrillators provide only a single therapy regimen.

It has been observed that atrial activity associated with atrial arrhythmias can vary in organization from highly organized activity to highly disorganized activity. Atrial flutter, for example, is a highly organized atrial arrhythmia. Atrial activity of increasing disorganization, beyond atrial flutter, is generally referred to as atrial fibrillation. Atrial arrhythmias, therefore, encompass a wide range of organization and disorganization from atrial flutter, which is highly organized, to atrial fibrillation, which itself encompasses a wide range of atrial activity organizational characteristics, from what may be referred to as atrial activity of intermediate organization to atrial activity of high disorganization. Recognizing these atrial arrhythmia characteristics, Wells, Jr. et al. in *Characterization of trial Fibrillation in Man: Studies Following Open Heart Surgery*, Pace, Vol. 1, pp. 426-438, Oct-Dec, 1978, type characterized various forms of atrial fibrillation and further reported that the atria, during an arrhythmic episode, can transition between the characterized forms of atrial arrhythmias and can even self-revert to normal sinus rhythm. In addition to the above, it has been more recently learned through research sponsored by the assignee of the present invention that the amount of cardioverting electrical energy required to cardiovert an atrial arrhythmia to return the atria to a normal rhythm increases as the degree of disorganization in atrial activity increases during an arrhythmic episode.

While atrial defibrillators which detect the simple presence and absence of atrial fibrillation (including atrial flutter) and which provide a single intervention regimen if atrial fibrillation is detected will provide needed relief for many patients, these devices for some patients exhibit certain deficiencies. For example, the single intervention regimen can result in a greater amount of electrical energy being applied to the atria than needed to successfully cardiovert the atria. This can submit the patient to a higher degree of potential discomfort than would otherwise be necessary. It can also result in a greater than necessary consumption of battery power which would ultimately shorten the useful life of the cardioverting device. As another example, and at the other end of the organization spectrum, the atrial activity may be so disorganized that the implanted defibrillator is incapable of providing a sufficient amount of energy to cardiovert the atria. Where a single intervention regimen is utilized, therefore, cardioversion would still be attempted with a quantity of cardioverting energy which is less than that required to cardiovert the atria. This would also submit the patient to therapy destined to be ineffective and, hence, therapy which should not be applied, while wasting precious battery power.

SUMMARY OF THE INVENTION

The present invention therefore provides an atrial cardiovertor/defibrillator including criteria establishing means for providing a respective different criteria for each of different types of atrial arrhythmia, a sensor for sensing activity of at least one of the atria of a heart to provide an electrogram signal, and therapy means for providing a corresponding therapy to the heart for each of the different types of atrial arrhythmia. The atrial cardiovertor/defibrillator further includes classifying means responsive to the electrogram signal and the criteria establishing means for identifying one of the types of atrial arrhythmia and causing the therapy means to provide the therapy to the heart corresponding to the identified one of the types of atrial arrhythmia.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic block diagram of a fully implantable atrial cardiovertor/defibrillator embodying the present invention, shown in association with a human heart in need of atrial arrhythmia monitoring and potential cardioversion.